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NOTICES OF The Aeronautical Society.

A Meeting of the Council was held on Sept. 15th, when the following gentlemen were elected Members of the Society :—

JAMES D. WHITE, Esq., 3, Paper Buildings, Temple, E.C.

H. S. ELWORTHY, Esq., Havre des Pas, Jersey.

Prof. SIR WILLIAM CROOKES, F.R.S., &c., 7, Kensington Park Gardens, W.

M. AUGUSTE E. GAUDRON, 7, Victor Road, N.

B. BADEN-POWELL, CAPT.,
Hon. Sec.

Ader's Flying Machine.

More detailed descriptions of this apparatus, which was briefly referred to in our last number, have now been published.

M. Ader, who is a French engineer, has devoted much study to the flight of birds, and to the construction of their wings, and claims to have made a discovery which has an important bearing upon the subject of artificial flight. He has observed that Nature has adopted in the structure of the wings of birds, insects, and all flying things a special well defined geometric curve, namely, the spiral. Every feather taken separately obeys the same law; the curve is more or less accentuated according to the weight of the wing, but it is always present, and this principle, M. Ader maintains, should form the basis of all attempts at aerial locomotion. He has therefore abandoned the plane surfaces hitherto adopted, and has substituted curved surfaces, characterised, like the mysterious boomerang of the Australian aborigines, by the indispensable spiral. The wings of the "Avion," by which name M. Ader designates his invention, do not flap, and can only be moved backward or forward to permit of adjusting the centre of gravity of the apparatus. Their framework is of bamboo, and is jointed so that the wings can be folded if necessary. They are kept in position by steel wires, which act like tendons, and are covered with a light silk material. The apparatus is propelled by means of two large screws or helices, also constructed of bamboo, which are placed in front of the machine. They revolve in opposite directions, in nearly the same plane and are entirely independent. The motor that drives each of them is a marvel of power condensed into small bulk and is of little weight.

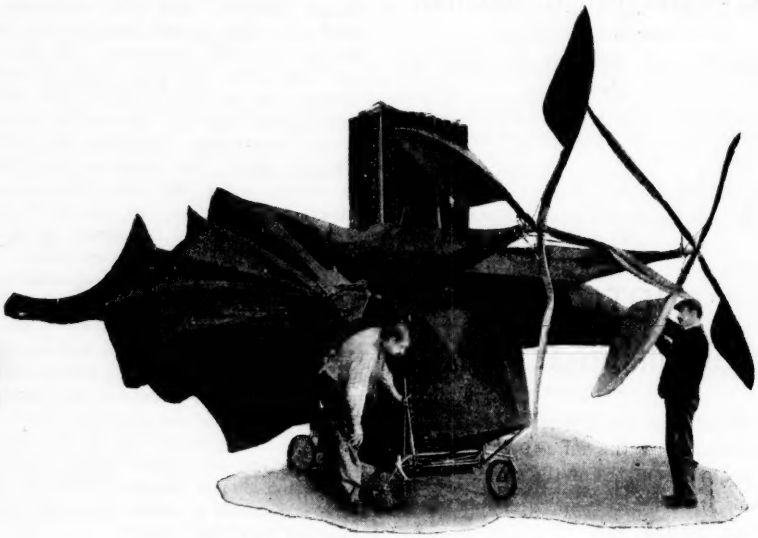
The motive power is furnished by steam. The fuel employed is alcohol. Each of the motors has four cylinders and operates by double expansion. The generator is tubular, and the vaporisation therein is practically instantaneous. When all the exits are closed to the steam, the pressure rises one atmosphere per second. The waste steam liquefies in an air condenser that is placed at the top of the apparatus and that permits of recovering the water without any loss.

Each motor is of 20-horse power. All the parts were worked out of blocks of forged steel, just as a bust is carved out of marble by a sculptor. Everything has been hollowed out that could be, and the result is that the total weight of the generator, motor, and condenser is about 6½ pounds per nominal horse power. The motor alone does not exceed the weight of 2 1-5 pounds per horse power.

As each motor directly actuates one screw, the velocity of either can be diminished at will; the result is that, in the steering, the propellers concur with the independent rudder situated at the rear. The latter is manœuvred by the aeronaut by means of pedals. Three or four buttons or handles, placed within easy reach, suffice for all the other manœuvres.

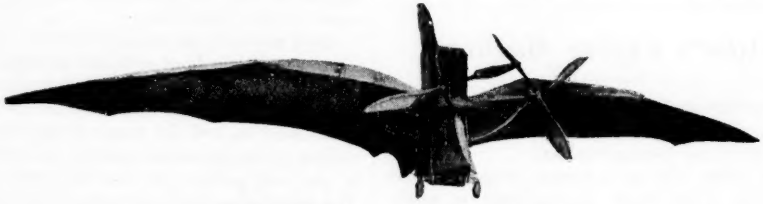
It measures about fifty feet from the tip of one wing to the tip of the other, and weighs, when fully loaded, about half a ton.

The French Government, keenly alive to the possibilities of the flying machine in warfare, supplied the funds for the construction of the machine, and M. Ader has been at work on it for the last five years, operations being carried on in secret, under the supervision of a committee of military experts. In October of last year the machine was finished and was conveyed to the manœuvring ground at Satory to be tested, strict orders being given that no strangers should be admitted to witness the experiments. Nature, as if jealous of her secrets, generally proves unkind at the critical moment on such occasions, and for a whole week the weather was so windy and unsettled that it was judged inadvisable to experiment with the machine, but on the 14th of October the day was calmer, and M. Ader took his place on his apparatus and set it going. With wings outstretched, the machine ran along on its wheels, slowly at first, but with a gradually quickening pace. At last the onlookers saw the wheels leave the ground, and the machine turned slightly owing to the breeze. The moment of M. Ader's triumph had come, but it was of short duration. A second later a squall struck him, and, fearful of the results, he slowed down. The machine immediately dropped to the ground, and the wheels being no longer in the line of motion did not run, but jammed, One of the wings broke, the machine fell on its side, the screws were smashed to atoms, and when M. Ader



PREPARING FOR THE FLIGHT.

[Illustration from *Golden Penny*.



WITH WINGS OUTSTRETCHED.

[Illustration from *Golden Penny*.

got free of the wreck he found only his engines intact. However, the machine had actually raised itself into the air—everyone was positive on that point—and so the committee of experts, in their report to the Minister of War, stated that in their opinion the experiments should be continued, it having been proved that the motive power was sufficient to lift the machine, and that the wings were capable of carrying the apparatus and its inventor.

The machine has now been repaired, and being furnished with wheels that will turn in any direction, a similar accident is no longer possible. The inventor is only awaiting the order of the Minister of War to make another start, and any day we may hear that the problem of aerial navigation has been solved.

Experimental Soaring.

Some years ago I got over a soaring apparatus from Lilienthal, and made some experiments with it in Trinity College, Dublin. The college grounds are flat and sunk below the city and surrounded by trees, so that it is a very unfavourable place for experiments of the kind. The conditions for successful soaring are a pretty steep incline *up* which the wind blows, and the only incline I could command was an inclined scaffolding I had erected. round which the very gusty wind blew, making it very difficult to keep any sort of balance even when standing. I also made experiments with the willing assistance of several students on being dragged along against the wind. I found that this was a rather dangerous experiment, partly on account of the irregularity of the gusty wind and partly on account of the difficulty of controlling a number of students, when once started in a team running across the Park. The gustiness of the wind made it impossible for me with the little practice I had had to keep the plane of the machine level, and one wing thus scraped along the ground. If my team of students could then have been quickly stopped, there would have been but little danger, but, as it was, there was considerable danger that the ribs on the side scraping the ground being broken, their splinters should be driven into me, an accident that might have very serious results. I also tried experiments on sending up the apparatus as a kite by itself, and with myself and a light student in it. I had several guide ropes to ensure its not diving in the way that kites so frequently do when rising in the gusty air near the ground, and I found that, even in the gusty air of the College Park, the apparatus flew admirably as a kite. During pretty strong gusts it was almost able to raise my weight (about 11.5 stone), and was well able to raise the student.

As a result of all my experiments, I am quite confident that, in a steady breeze, it would be quite feasible to soar with apparatus of this kind, and am writing this article in hopes that some person who resides in a suitable locality will make experiments in furtherance of our knowledge of how best to balance a soaring machine. If the experiments are conducted on the lines I indicate, I do not think that they need be dangerous; but nobody should lightly undertake experiments of the kind nor should they venture to rise more than a few feet from the ground without having made innumerable experiments at small heights on the lines they intend to follow at greater heights.

The kind of locality suitable for these experiments is an open, pretty steeply sloping field, where there would be a good prospect of having a steady breeze blowing straight up the slope. Herr Lilienthal constructed a conical hill, in order that he might be able to make experiments thereon in every direction, so as always to face the wind. No artificial mound of this kind can however be large enough to deflect the wind much upwards. The wind will largely blow *round* it, while it is essential for the experiments I desire to see tried that there should be a considerable upward component in the wind. From my experience, I should say that some locality near the sea would be found most suitable, as the wind near the sea coast blowing from the sea is generally very much steadier than the wind at inland stations, and, certainly at first, it is important that the wind be as steady as possible, so as not to increase the difficulties of the experimenter.

Having selected a suitable locality and a suitable day, the experimenter should have two long ropes fastened to the lower side of the soaring machine, and attached to two points in that lower side about four feet apart. From that they should stretch, making an angle of about 60 degs. with one another, to two fixed anchorages at the bottom of the slope. The soaring machine should be near the top of the slope, and should be fastened by short ropes to anchorages in its own neighbourhood, these being so arranged that the machine may not be able to rise more than five or six feet from the ground, nor when so high be able to dive forward or backward. All this having been carefully ensured by experiments made with the machine, thus flying like a kite with its several guide ropes, the experimenter might

get into the apparatus, and, if the wind were strong enough, he should have no difficulty in flying like a kite, with the various guide ropes all tight. All this can undoubtedly be secured, as I and other have gone so far. The next thing to do is to try and arrange one's balance in this kite, so that it may lie sloped a very little downwards in a forward slope. Kites always fly sloping upwards, but on the upward draught of air on a hill slope must be possible to fly with the kite sloped a little downwards toward the wind. In this position the drag on the forward ropes would cease, and the kite, if too much sloped forward, would tend to slide down the air in the way that Herr Lilienthal so frequently succeeded in doing. This would, however, be stopped by the guide ropes I advocate, and is not the action I think should be aimed at. What the experimenter should aim at is such a slight forward slope as would only just relieve the tension on the forward ropes, and leave him and the aeroplane balanced in a steady, or nearly steady, state on the draught up the hill slope. This is an action we frequently see used by seagulls on the sea cliffs. They stand with motionless wings balanced on the upward air current near a cliff or hill, and can, by merely changing their balance, sail foward or backward, upward or downward, to one side or the other, without any exertion of power. Before we can hope to emulate their many actions, we must learn to balance ourselves on the upward air current by means of the aeroplanes, and I believe that constant practice with the aid of guide ropes such as I described would enable a careful experimenter to learn the art without any serious risk.

Besides the delight of being able to accomplish so much, and the hope that one might in time, and with favourable breezes, emulate the manoeuvres of seagulls, a great deal of valuable information could be acquired as to the general question of balancing in the air, and on the effect of gusts of wind, and possibly as to the ultimate utilisation of the gusts as means of flying. The accumulation of experience by careful experiments is in every way desirable, for without a great deal more experience than we at present possess, it is impossible to say how far we may be able to imitate birds without a large expenditure of power on our part. There can be no doubt, that the power at the disposal of birds is far greater than they require for much of their ordinary work, and I have no doubt that under favourable circumstances we could utilise the wind to provide us with the power required in the same way that, there can be no doubt, many birds do.

I may make a remark as to the posssibility of using a perfectly uniform breeze, which seems to have been overlooked by those, and they are many, who do not see that it is impossible to do so continuously. The air we live in is always blowing along at a most tremendous rate. It is going about twenty miles a minute at the equator along with the rotation of the earth on its axis, and about nineteen miles a second along with the earth round the sun. Why cannot we use these desperate hurricanes to fly by? How do they differ essentially from any other perfectly steady breeze?

GEO. FRAS. FITZGERALD.

Trin. Coll., Dublin, July, 1898.

Balloons for Geographical Research.

By Captain BADEN-POWELL.

(Extract from Paper read before the British Association at Bristol.)

Many difficulties beset explorers in wild countries. Much time has to be devoted to the journey; transport of supplies, hostility of natives, progress through jungles, marshes, and rivers impede the traveller. Long sojourns and hard work in hot and unhealthy climates, or extreme cold, all present great difficulties. There is, however, one high road which leads unobstructed to all parts — the air. An aeronaut, seated in the car of a balloon, floats along above all impediments and obstructions, travelling day and night at the speed of the wind, and with an extensive view of all the country below. But there are two practical difficulties to be overcome. First, the ordinary free balloon must travel wherever the wind chooses to take it, and that may be in any but the desired direction; secondly, no free balloon has as yet ever remained up longer than a day or two.

The question thus arises, can a balloon be sufficiently improved upon to make it a serviceable means of geographical exploration? As for being diverted out of an unsuitable wind course, three general methods for doing so have been suggested and even tried: (a) To propel the balloon with a screw or other propeller after the fashion of a steamer, or, rather, a torpedo. Many attempts have been made in this line, but the most satisfactory only resulted in a speed of about 14 miles an hour, insufficient to stem any but light breezes. However, if such an apparatus could be practically

propelled at this speed for many hours on end, it would prove of the greatest value for our purpose, a considerable deviation could be made from the actual direction of the wind, and a direct course steered during light winds and calms. (b) To take advantage of varying currents of air at different elevations. This method, however, cannot be relied on. Though there are occasionally different currents at different heights, there is by no means any certainty of finding suitable ones (at all events out of the regions of trade winds). (c) By having a connection with the ground, such as a heavy guide rope. This, by its friction retards the speed, and enables a balloon, if fitted with a sail, to be steered to some extent out of the wind course. This system, first suggested by Green, and practically utilized by Andree, has the advantage of being very simple, and the guide-rope also performs other valuable functions. Andree hoped to be able to maintain as great a deviation as 30 degs. on either side.

One of the chief causes of the ordinary free balloon giving out so soon, is owing to its varying elevation. When suspended in mid air it forms a very delicate balance. The least addition of weight, such as the damp from a cloud will cause it to fall. The least lightening of it, as from the expansion of the gas by a warm sun, makes it rise. These continual elevations and depressions necessitate a loss of gas and of ballast. Here again various ideas have been brought forward to rectify this drawback. Vertical screws, worked by hand or by a small motor, might prove of use, though ballast, to compensate for loss of gas, or for any great acquisition of weight as from a shower of rain, would have to be taken too. A pump to compress the gas, or atmospheric air, is theoretically a good means of obtaining the requisite addition of weight when required, but in practice the apparatus is too cumbrous. Lamps to heat the gas have been suggested, but one is apt to forget the enormous volume of a large balloon; it may be compared to warming a large hall with a small spirit lamp. Liquefied gas may in time be employed, though perhaps hardly practicable at present. The addition of a long guide-rope trailing on the ground is, however, a most efficient means of regulating the height at which a balloon is to float. Every tendency to rise necessitates the lifting of more weight of rope. Every downward movement lays more on the ground. The guide-rope, then, is a most important adjunct, though seldom applied in practical ballooning, solely on account of the damage it would cause to crops, houses, etc., in civilised countries.

Actual leakage of gas is not a serious matter with a good balloon, as sufficient ballast can be carried to compensate for it. Gold-beater-skin balloons are undoubtedly the tightest. A balloon at Aldershot has remained inflated for three months on end with very little loss. Andree, on the other hand, with his silk balloon, had the greatest difficulty in stopping up the needle-holes of the seams.

The idea of utilising a "Montgolfier" or hot-air balloon is out of the question, as requiring such an immense supply of fuel to keep it up for any length of time.

There is one more method of travelling through the air which is worth mentioning—that is, man-lifting kites. I have previously demonstrated the feasibility of lifting a man by this means, and doubtless there would be no practical difficulty in lifting a car with several men and supplies. I have also shown that if the lower end of a kite string be attached to a loose heavy rope, the kite will tow it along over the ground, and itself remain in the air even supporting a considerable weight. Here then is a method of utilizing the guide rope without the leaky, touchy, and delicate balloon! Rough calculations, however, tend to show that an enormously heavy rope would be requisite, too large in all probability to be practically manageable.

Having come to the conclusion, then, that a balloon *is* a practical means of exploring unknown countries, we may consider what will best constitute our equipment. Before deciding on the details of a balloon outfit for such a journey, the locality must be named. Considering all things, I know of no country which presents so many most desirable qualifications as Egypt; steady northerly winds always prevail up the Nile, the deserts on either side are most favourable ground for trailing over, Cairo forms a well supplied base to start from, and the longer the journey is continued, the more interesting does the country become. I think the following would form the most suitable equipment for such a country.

I should suggest several balloons. One of about 60,000 c. ft. and, say, six smaller ones of about 7,000 c. ft. Then, if one gets torn or damaged, the others might remain intact. After a time when gas is lost, one of the smaller ones could be emptied into the others, and the exhausted envelope discharged as ballast; the smaller balloons would be easier to transport by porters than one big one; and they could be more easily secured on the earth during contrary winds.

Over the main balloon a light awning might be rigged to neutralize as far as possible the

changes of temperature. A lightning conductor to the top of the balloon might be desirable. A large sail would be arranged, and a bifurcated guide-rope attached to the ends of a horizontal pole would form an efficient means of steering. The car would be boat-shaped and waterproofed, so that it could be used for a return journey down a river. Water-tanks would be fitted. The weight would probably be somewhat as follows:—

	lbs.
Balloons, with nets and cover	2,000
Car, with water tanks	400
Four men, with personal effects	800
Sail, pole, anchor, and cables	200
Guide-rope (portion suspended)	1,000
*Food, 30 days at 3 lbs. per man and waste	400
*Water, ,, ,, 1 gallon ,,	1,200
Instruments, guns, cooking apparatus	200
Ballast (for emergencies)	800
	7,000

* Daily consumption of these two, 53 lbs.

The 100,000 c. ft. of hydrogen which the balloon would contain would just about lift this (regulated by the guide-rope). If the loss of gas amounted to as much as 2 per cent. per diem, it would be compensated for by the discharge of 140 lbs. of ballast, but the ordinary consumption of supplies and the occasional discharge of a balloon would account for a large portion of this. Thus, it is evident that the balloon might be able to keep afloat, if necessary, for over three weeks, leaving a good supply of provisions. If the speed averaged 12 miles an hour, the journey could be prolonged for 6,000 miles!

Mr. Bacon's Scientific Ascents.

A series of experiments in aerial research have, during the last three months, been carried out by the Rev. J. M. Bacon. The objects in view were numerous, but acoustical tests were the chief features. The following were laid down as the special objects to be achieved:

To test many forms of speaking trumpets, transmitters, and receivers.

To discriminate between the audibility of band instruments, singly and in concert.

To make investigations (various) of echoes, "acoustic clouds," and the decay of sound on diverging from axis along which generated.

To measure velocity of sound between earth and upper strata.

To experiment on pitch and audibility of instruments taken aloft.

To decide the maximum range down wind (1) of human voice; (2) powerful sound instruments.

To note rise and fall of sound of church bell, as heard remote from local influences, e.g., whether merely fitful, rhythmic, or otherwise.

To look for conspicuous stars before sundown, noting their altitude and angular distance from sun.

To look for alleged markings on the surface of Venus.

To note any darkening of the sky in ascending.

In regard to refraction, to take snap-shots of the sun disappearing below sea horizon at known times and altitudes, with simultaneous temperature measurements.

To observe and photograph the spectrum below and aloft, determining the proportion of telluric lines, etc.

To investigate by photography the relative actinic qualities of the atmosphere at different elevations.

To measure atmospheric electricity by a Kelvin's electrometer.

To experiment with Aitken's dust counter.

To entrap air at high elevation, to be examined by Professor Ramsay.

To record the lag of aneroid barometers during descent.

To attempt to photograph the Solar Corona from high altitudes.

Mr. Bacon, it may be said, is an old scholar of Trinity College, Cambridge, who although ordained, has devoted his life to astronomy and other sciences. He has a splendidly equipped observatory and laboratory at his home in Thatcham. It was at his own workshop that most of the instruments made for his researches recently were manufactured. His parabolic receiver, or sounding board, has been made by Mr. Maskelyne, of Egyptian Hall fame, with brown paper. The speaking-tube was based upon the tube used in the Spanish Navy, and the sound receivers were old casks ingeniously wired and utilised for this business.

The first ascent of the series took place on July 27th, in the grounds of Shaw House, near Newbury, in the presence of several thousands of spectators. The experiments were carried out under the direction of the Rev. J. M. Bacon, Dr. R. Lachlan, Mr. J. N. Maskelyne, and others, with the advice and assistance of Lord Kelvin, Lord Rayleigh, and other scientists. The balloon was in charge of Mr. Percival Spencer and his brother, and was filled

with 40,000 cubic feet of gas. The ascent was successfully made at twenty minutes past five o'clock, the balloon drifting steadily in a north-westerly direction. As soon as the balloon had had a fair start, the series of experiments commenced. The first experiment in acoustics was with the voice, followed by five tests with musical instruments, these being succeeded by the discharge of rifles and blasts of the syren from an engine. Then came a rifle volley, a roll of musketry, and discharges of cotton-powder, 4 oz being used in each charge. After this came three further discharges of cotton-powder, with 8 oz. in each charge. When the balloon had travelled a considerable distance, there were two explosions of cotton-powder with double charges, the final experiment being a comparison between a discharge of 4oz. of gunpowder and 4oz. of cotton-powder. The aeronauts had with them a receiving instrument, and by noting the altitude and the sounds which reached them, took the angular distance. The balloon made an excellent descent at ten minutes to seven o'clock at North Denford. All the experiments proved highly successful.

Mr. Bacon made a second ascent on Aug. 12th. As assistant, he chose his daughter, Miss Gertrude Bacon, who, as a working member of the British Astronomical Association, has accompanied her father on the last two eclipse expeditions. The inflation of one of Messrs. Spencer's larger balloons commenced about noon in the Crystal Palace grounds. About this time, however, the breeze began to freshen considerably, and shortly became a strong wind. At about half-past four in the afternoon, the ascent was made, and the balloon rapidily rose to nearly 6,000ft., at which elevation it sailed over London at a great speed, crossing the Thames between the Tower and London Bridges. The view was exceptionally fine, and the cameras were busy. It is stated that important observations were made, including some remarkable aerial echoes and other acoustical effects. The spot chosen for the descent was near Ashwell, in Hertfordshire. Here the anchor scorned the hard surface, and there commenced a lively little steeplechase across empty harvest fields, the car boldly charging banks and boundary posts. Eventually it was brought up on a roadway, and Mr. Bacon and his daughter were able to proceed to Cambridge by the last train.

The third ascent took place on Aug. 20th from the Crystal Palace, the descent being made at Rainham in Essex.

Mr. Bacon, in the "Daily Mail," relates:—

The fourth of the present series of balloon ascents took place at the Crystal Palace on Saturday, September 3.

In addition to meteorological records it had been determined to take photographs from high elevations, to collect air at different heights for subsequent examinations, to test the proportions of foreign matter in suspension, and to make experiments on the behaviour of sounds under fresh conditions of atmosphere and locality.

It was desirable, if possible, to attain an height of several thousand feet, and to continue the investigation as long as practicable. On the eve of starting I appealed to our aeronaut, Mr. Percival Spencer, and asked him if, as the day was calm, he could not dispense with the extra weight of his heavy anchor and trail-rope.

The afternoon was perfect for our purpose; warm, still, and almost cloudless, with only such summer haze as tones the sky to greyish blue. Suburban London looked its brightest. For a while we lingered over well-known haunts. We took frequent snapshots as we drifted slowly to the S.S.E. at a height of hardly half a mile. From the moment of starting one peculiarity in the physical conditions prevailing was abundantly apparent. The air was not in fittest mood for conveying sounds. The cheering of the crowd in the Palace grounds had quickly faded.

In twenty minutes from the start we were sailing over Bromley. Presently Tunbridge and Tunbridge Wells lay beneath us. Then 4,000, 6,000, 8,000 ft. were rapidly recorded. Soon we looked down from a mile and three-quarters high. What a sight it was!

The sea was well in sight. Beachy Head stood bold and bluff on the right. Dungeness was away on the west as far down, but straight in front and rapidily approaching, were unmistakable outlines of the twin towns of Hastings and St. Leonards.

We were already over the houses. Beyond them were the cliffs 100ft. high, and beyond—the open sea.

Already we were swooping down with a rush.

"Ready with this sandbag," broke in Mr. Spencer, "and look out." The next moment circumstances were all altered, as we were caught by a strong undercurrent, and wafted towards Fairlight. And so we cleared the housetops after all, and coming down in a harvest field, bowled over on our side before a stiff sea breeze, with, of course, no anchor to hold us.

Post and rails were ahead, but we crashed

through them unchecked, and now only a belt of trees barred us from the cliff. The next moment a brave old oak brought us up.

The fifth ascent of the series took place at the Crystal Palace on Saturday, Sept. 10th. Mrs Lachlan, wife of Dr. R. Lachlan, of Cambridge University, occupied a seat in the car, Mr. Percival Spencer being in charge. Experiments in acoustics were made, and photographs of the country crossed taken. The balloon at times reached an altitude of about a mile. After four hours' journey a descent was made near Dover.

The sixth ascent was on Sept. 12th, from the grounds of Clifton College. The following is the graphic account which Mr. Bacon gave to a "Daily Mail" representative:—

"The arrangements were perfect throughout, and at 4.30, the hour of starting, the balloon was straining at her moorings, and 2,000 onlookers, the specially invited guests of the British Association, lined the enclosure. A few genial well-wishes from scientific friends, and a parting word from Professor Ramsay, on whose behalf it was my aim to bring down a sample of the atmosphere from our highest elevation, and Mr. Percival Spencer and myself were up and away.

"We rose at once 3,000 feet, from which height we looked down on surely one of the most noteworthy spots on earth, through an atmosphere which, despite all the smoke that Bristol could produce, was the clearest I have had experience of in the upper regions this season.

"Our observations aloft quickly showed us a temperature markedly lower, and far less thirsty than we have yet recorded. From the North Atlantic a cold, moist current was sweeping by, not half a mile above parched and panting England. It had manifestly altered the conditions of floating matter.

"The dust counter gave a reading practically nil at a stratum where six weeks before hovered an ocean of dust-motes. The light reflected out of the air, and sifted by the prisms of spectroscope and polariscope, told the same tale in different language, and the upper air, tested for photographic action, showed a rapidly altering rate, while its power of conveying sound was very remarkable indeed.

"The conditions seemed identical with two days before, when the toot of a horn came back to us from earth over 2,400 ft., occupying nearly five seconds in making the double run.

"One more example of the carrying power of air that afternoon. At a full half a mile up, while flying over Keynsham, a piece of thistledown passed us, and in a great hurry too, still mounting upwards. It seemed to have a mission to fulfil before nightfall, when descending cooler currents would bring it down.

"This was our case also, and when we had taken our sample of air at the greatest height we prepared for a descent, which, all ballast being spent, took place rapidly.

"We came to earth near Frome."

On Sept. 28th a night ascent was made by Mr. Bacon with Mr. P. Spencer and a reporter of the "Chronicle," from the Crystal Palace After attaining an elevation of 3,000 ft., a descent was made at Aylesford, in Kent.

Aeroplane Experiments.

By L. Hargrave.

(Paper read before the Royal Society of New South Wales.)

Since the paper on the possibility of soaring in horizontal wind was read, no efforts have been spared to determine the essential features of curved surfaces that are of any practical utility to aeronautics, and the model shown in Fig. 1 embodies what is known to date. The poles and horizontal cord have been found a most useful method of experimenting; indeed, it may safely be said that without them the trifling amount of available wind would have been quite inadequate to find out anything new. As suggestions to those who wish to advance this matter rapidly, it may be stated that the wind near the ground is comparable to the surf on the sea shore, which all will admit is not suitable for testing the sailing capacity of yachts or boats. To utilize wind from all directions, a platform of wire netting should be placed in a situation like the top of the shearlegs on Garden Island. The top of a building, cliff, or rugged mountain would be unsuitable as walls and vertical surfaces merely create the aerial breakers which it is the wish of the experimenter to avoid.

It is well at this point to have a distinct understanding that soaring is quite different from kite-flying and gliding. In gliding, as practised by Lilienthal and others, a free apparatus descends from an eminence, and its fall is more or less retarded by the air on which it slides. In kite-flying, a weight attached to the earth is raised and supported by the wind sliding under it. In soaring, the mechanism is unattached to the earth, and maintains its elevation by using as a motor the vortex that its peculiar shape generates. Most people would at

once say the last statement involves perpetual motion, and therefore is not worth considering; a few will see that a ball retaining its position in front of a nozzle against gravity and the downward thrust of a high-pressure jet of water is a close analogy to the soaring vortex. The water clearly makes the ball weigh less than nothing. There is little doubt that the weight of a ball dancing on a fountain is greater than when it is at rest.

The makers of soaring models will find great difficulty in persuading them to remain tolerably stable in a fore and aft direction. The trouble will be greatly reduced if they avail themselves of the experience of a tight-rope walker with his balancing-pole. The acrobat makes his pole as long and stiff as possible, and puts as much weight on the ends of it as he conveniently can; he then has no further difficulty with his athwartships stability. It is the inertia of the weighted ends that takes the wobble out of his body. Likewise the weighted ends of the fore and aft tubular rod in Fig. 1, check the erratic motion of the vulcanite propeller.

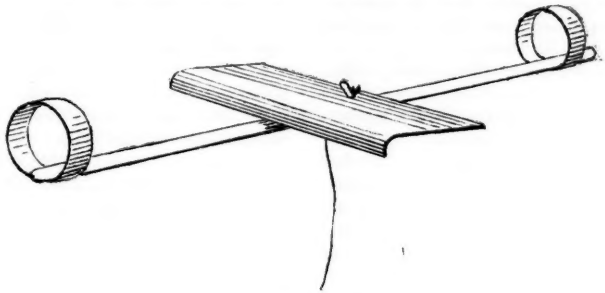


FIG. 1.

When you consider the conformation of a soaring bird, it will be noticed that a large part of the under surface is not adapted for the formation of the soaring vortex. The tips of the rigid wings and tail are obviously of such a nature that they will not readily allow the bird to rise or fall suddenly when the soaring parts of the wings are struck by a gust from underneath or above. These surfaces are represented in Fig. 1 by the horizontal projection of the surfaces of the two cylindrical cells at the ends of the tubular rod. The vertical projection of the two cells represents the vertical surface of a cellular kite or the dihedral angle of some soaring birds.

The parts of a soaring bird's wings next to the body are represented in Fig 1 by the bent sheet of vulcanite. This is the propeller, and it makes sufficient thrust to overcome its own head resistance and that of the rod and two end cells. No attempt has yet been made to ring the changes on the numberless curves that probably soar; the essential points seem to be that the front part of the propeller shall be bent to about the quadrant of a circle, the extreme after part plane, and the intermediate portion hyperbolic. Rigidity of construction is all-important. Springy and vibratory surfaces are not conducive to steady soaring; their practical effect is to increase the head resistance. No curved surfaces made of muslin have yet soared; the nest for the vortex must be hard and smooth.

The tubular rod and two end cells form really a cellular kite, and their head resistances are reduced to the utmost. In Fig. 1 the total area exposed is 1.27 square inches, without making any deduction for rounded edges. In addition to this there is the drift of the two strings, which in practice will be dispensed with. The horizontal projected area of the cylindrical cells is 46.8 square inches, that of the propeller 165 square inches, total 211.8 square inches; the total weight, 1.53 lbs., give a weight of 1.04 lbs. per square foot.

The force of the wind required to make any show at all with the model depicted must be at least fourteen miles per hour; light north-east and west winds have been a sore trial to the writer's patience, south-east and east being the only winds from which any results can be expected in the locality where the experiments are being carried on.

The centre of gravity in Fig. 1 is 2.6 inches abaft the leading edge of the propeller, and 3.725 inches forward of the middle of the tubular rod. The string is attached to the centre of gravity. The vulcanite propeller is fastened in such a manner that the angle it makes with the rod and cells can be varied from $+1^\circ$ to $-14\frac{1}{2}^\circ$; the best results in light

winds have been obtained with about 3½ degs. negative angle. There is no way of finding accurately at what angle the wind strikes the cells; the rod appears to be horizontal.

A light string is tied to the after end to prevent the kite rushing over the horizontal cord; this string is slackened out till the kite is near the level of the top of the poles and in a horizontal position facing the wind; it then soars to windward, sometimes over but more frequently under the cord. Sometimes the kite can be steadied near the zenith by means of the tail string.

The question arises as to what is the use of trying to make a large soaring machine, if under ordinary circumstances one may wait weeks for a few hours' trial with small models. Irrespective of the pleasure to be derived from attempting to unravel Nature's secrets, there is the prospect that an apparatus fitted with soaring curves may be raised by thrust in calm weather with greater facility than the ordinary screw-driven aeroplane; and that although the air is calm near the earth's surface, a few hundred feet elevation would bring the machine into disturbed air, where the soaring curves would develop their full power and the machine could then proceed without steam.

The late gales (May 5) enabled me to find out that the pounds per square foot suitable for a fourteen miles per hour wind did not give as good results in thirty-five miles; and served to show that there are three cases in which soaring is possible:

Case 1. When all the surfaces are shaped for soaring. This form of apparatus will be extremely difficult to steer.

Case 2. When the cellular kite part of the machine is inclined at a slight positive angle This form is for use in the lightest winds in which soaring can be done.

Case 3. When the cellular kite as well as the propeller is at a negative angle. This is for very strong winds.

There is no reason why the propeller should not act if the axis of the vortex is not horizontal. Possibly concentric ring propellers may be found to give steady and uniform results with little weight. The kite shown in Fig. 1 has been greatly improved by increasing the rigidity of the tubular rod; it is now .55 inch external diameter, and all the ballast is put inside the ends. There is 12.75 inches of .5 inch round lead in the forward end and 6.75 inches inside the tail. This brings the weight up to 1.9 lbs. per square foot. When loaded to 1.87 lbs. per square foot with a wind of sixteen or seventeen miles per hour, the propeller set at a negative angle of 6.3 degs., and centre of gravity 3 inches abaft the leading edge of the propeller, it has frequently soared to the end of its tether.

The soaring kite with the double propeller rolls very sharply; this is thought to be due to the centre of gravity being too low. The rod is now clamped to the steel wires joining the two parts af the propeller, in such a way that it can be adjusted vertically.

As it seems impossible to arrange for the members to see these particular experiments, it is thought that an accurate drawing of the model is amply sufficient to enable others to reproduce and extend the elementary observations here recorded.

The principal points that require investigating, are:—

1. How much the after edge of the propeller can be cut away without impairing its efficiency?

2. What is the diameter of vortex that is best for general use?

3. How many propellers can be advantageously superposed?

4. The proper relation between the propeller area and the kite area.

5. The shortest rod that will keep the longitudinal equilibrium stable.

6. What is the supporting power of the propeller when used for gliding, as compared with that of the gliding machines now used?

7. Can the vortex be produced by a motor in calm air, so as to be more economical than the thrust of a screw?

8. To make an instrument to show simultaneously what pressure there is at every part of the concave and convex surfaces of the propeller.

These alone form a large volume of work for one pair of hands to endeavour to accomplish, and it appears regretable that Australians should leave to Americans and others the tardy adoption of the views circulated by this Society.

A steam screw motor, which is intended to develop five or six horse power, has taken up much time, but as yet it will not work in a reliable manner. It is of course quite a secondary consideration while the soaring kites are developing. The water is contained in the square part of the tubular frame, and the kerosene in the centre upright part. The cylinders (2) are 4.25 inches diameter, the stroke is one inch, and they rotate with the screw. The shaft is clamped to the frame. The boiler is made of one hundred and twenty-four feet six inches of 5-16 inch copper pipe, with 10.27 square feet outside heating surface; the capacity is 88.4 cubic inches. Weight of

pipe is 8.37 lbs., coiled eight and a-half inches outside diameter. The upper two-thirds of the pipe branches into two parts, joining again at the steam pipe. The fuel is vaporised in seven feet six inches of one-quarter inch copper pipe coiled inside the tin burner casing shown under the boiler. The total weight of the motor exclusive of water and kerosene is 36.5 pounds.

The principle that long continued thought on any subject must tend to a clearer view of the detail connected therewith, has encouraged me to state some considerations as to the disposition of the supporting surfaces of flying machines that do not seem to have yet struck other experimenters.

It has been usual to make the lifting surface in one or more pieces rigidly connected to the weight to be lifted. In the machine for the engine, it is intended to depart considerably from this practice by dividing the required surface into numerous small aeroplanes, all attached to the weight by one wire.

The aeroplane derives its lifting power either from moving air passing it when attached to the earth, or from being moved horizontally through calm air; in either case there is no necessity for the aeroplanes to be connected to the weight by rigid booms and numerous stays, as the lift and drift can act only in tension and in one vertical plane. By dividing the surface into a number of small planes, any refinement of curve may be introduced with the certainty that the advantage accruing therefrom will be effectively used, and that the head resistance will be reduced to a minimum.

It will be obvious that forty aeroplanes of ten square feet area each can be constructed with much less material for spreading them horizontally than one plane of four hundred square feet area. In fact, we are substituting arithmetical for geometrical progression in the weight of our surfaces and their head resistance, and lifting our machine pound by pound with foot by foot of added surface. We are also able to unite very large and therefore more efficient engines with the extraordinary lifting power known to exist in small and carefully curved aeroplanes. You will gather from these remarks that the proposed flying machine will be a rather tall structure, and that fact alone will make it extremely easy to work and certain in its action.

The most suitable time for experimenting will be when the wind velocity is slightly below that at which the machine is designed to fly. The aeroplanes are sent aloft kite fashion, the anchor restraining the drift. Steam is then raised and the propeller started; if it is driven hard enough the machine rises over and picks up the anchor; if the power is insufficient no risks have been run, and there are no damages to repair.

There is no special gear for causing the machine to ascend or descend; it is simply a matter of more or less steam. The turning to the right or left is done by pulling slightly on one or other of two strings attached to the forward corners of some of the lower aeroplanes. The weight is kept from spinning round by some small vertical surface to the rear of and in a line with the thrust of the propeller, so that it is immaterial whether the weight is deflected by the small vertical surface and pulls the aeroplanes after it, or the aeroplanes are made to shoot to one side by the strings and pull the weight after them. There will probably be an advantage in the motor working in air of less velocity than the higher current when going to windward.

It is not generally understood that when the motor has succeeded in thrusting sufficiently hard to run over and lift the anchor, the aeroplanes exert a steady lift on the motor, and that whether the wind blow high or low, or change its direction, the whole apparatus maintains a uniform velocity through the air as long as the engine maintains a uniform speed. Of course the machine will drift with the air currents, but this set has to be allowed for and a course shaped accordingly. The set of the air current would be unknown if the earth were invisible; in like manner that the set of an ocean current is not ascertainable when out of sight of land without the aid of astronomy.

If there is no wind at all, there is no means of getting this form of flying machine aloft except by making a more or less extended run along the ground. This run may be then made round a circular track. In the event of the motor stopping, the machine does not fall vertically as a parachute, but slides down gradually in any desired direction. These remarks refer to the screw-driven aeroplane machine; if soaring propellers are substituted for some or all of the aeroplanes, a new power is introduced that completely modifies all preconceived conditions.

Notable Balloon Ascent.

(From "Daily Telegraph," Sept. 17, 1898.)

Mr. Stanley Spencer, the well-known aeronaut, and Dr. Berson, of the Berlin Observatory, ascended from the Crystal Palace in a balloon inflated with pure hydrogen gas, and reached

the remarkable height of 27,000 ft., more than five miles of vertical altitude, which is only 1,500 ft. less than that recorded by Coxwell and Glaisher in their celebrated trip of Sept. 5, 1862. To obtain some particulars of this noteworthy ascent, a representative of the "Daily Telegraph" called on Mr. Stanley Spencer, who was found at the balloon works of Messrs. C. G. Spencer and Sons, Canonbury.

"If you wish to know what scientific observations were made," he said, "I am afraid they will not be obtainable for a week or so. They were made in sealed instruments, and Dr. Berson is now on his way to Berlin with them. I may say that Dr. Berson was extremely pleased with the results, and declared that this ascent was the most successful of the series that he has been making at St. Petersburg, Moscow, and Berlin. I was present simply in charge of the balloon, and I have only the records made by my private thermometer and barometer. The aneroid showed that we had ascended to 27,500 ft., and the thermometer registered —29 degs. Fahrenheit, or 61 degs. below freezing-point.

Mr. Spencer proceeded to describe the trip. The balloon had a capacity of 56,500 cubic feet, and was inflated with 40,000 cubic feet of pure hydrogen, and to it was attached a basket-car 3 ft. 6 in. wide, 5 ft. long, and 3 ft. deep. The greater portion of the recording instruments were slung from the network of the balloon, so as to keep them at a distance from the car, lest the heat radiated from the bodies of the occupants might in some degree affect their correctness. Many of them were specially designed for the purposes of the trip. The balloon was inflated with hydrogen, nominally pure, but, as the smell which it left in the gas-bag showed, it was still some little distance removed from the odourless gas which the chemists define.

"Hydrogen is, of course, the most expensive, but its lifting power is double that of coal gas, and therefore it was selected for this trip. Coal gas will lift about 35 lbs. per 1,000 cubic feet. Hydrogen lifts 75 lbs. to 80 lbs.* Its use gets over one of the chief difficulties of ballooning. If you have coal gas, you must fill your balloon very full, and carry a lot of ballast. The reason is that it is impossible—and it is in this point, I think, that Andree went astray—to keep a balloon at an even height. It goes up, the gas expands and escapes, and it immediately descends; then ballast must be thrown out to lighten it, and up it goes again; and this ascending and descending process is repeated continually at intervals of varying length. Now, with hydrogen gas half the quantity is required; so that you need only half-fill the balloon, and when it expands the loss is comparatively slight, and the adjustment, by throwing out ballast, is much less."

The last and most important feature of the equipment was two vessels containing oxygen gas. How they contributed to the success of the trip will shortly appear.

"We started at five o'clock in the afternoon," said Mr. Spencer, "and travelled in a south-easterly direction. This lasted until we attained a height of 10,000 ft., and we did not like it because we saw the Sea Reach, at the mouth of the Thames, ahead of us (if one can say so, when it was so much below us), and we did not fancy descending into it, although we had lifebuoys with us. However, after 10,000 ft. we got into another current travelling south-west. It was a lovely day, and the air was extraordinarily clear. Usually, when one makes an ascent, one finds the view obscured by clouds; but on Thursday, at 23,000 ft., we could see the coast of France, along the east coast of England to the Wash, and a great deal of the English Channel, with dots on it for the steamers. It became dreadfully cold after this, but we were prepared with heavy woollen clothing, and particularly with wrappings for the legs, for they are shaded from the sun by the sides of the car, and usually suffer most. Still, in spite of our precautions, we were both shivering with cold. At 25,000 ft. the air was so rarefied that I began to become giddy, and had an indescribable sensation of asphyxiation. I looked at Dr. Berson who was busy at the instruments, and he was making a gurgling noise as he breathed. 'Oxygen!' he gasped, and so I handed him a tube which led from one of the oxygen vessels, and took another myself, and we put them in our mouths and sucked at them. The effect was marvellous, and instead of feeling exhausted, we felt quite exhilarated. At 27,000 ft. we had only four bags of ballast left, and they were necessary to ensure a safe descent. So, after registering another 500 ft., I pulled the valve-rope, and down we came. At the highest point I removed the oxygen-tube from my mouth for a moment, and at once the suffocating feeling seized me; but when I replaced it I recovered immediately. I feel confident that with a good supply of oxygen for breathing purposes we could go a great deal higher than has ever been done yet."

"How high is that?"

"Well, I am inclined to think that our ascent

* (?) 65 to 70 (Ed. *Aer. Jour.*).

was really the 'record.' I know that Glaisher and Coxwell reported that they recorded 29,000 ft., but after my experiences recently, I doubt it. I have been ballooning all my life, and may reasonably be supposed to have become accustomed to rarefied air; and Dr. Berson also has had much experience. Now, we both found asphyxiation become severe at 25,000 ft., and would certainly have been unconscious before 27,500 ft. but for the oxygen gas. Glaisher and Coxwell had no oxygen, and I really can't see how they could either of them have been conscious at 29,000 ft. I think that some error must have been made."

"We came down at Romford all right. We got a decent bump," said Mr. Spencer cheerfully, "but no harm was done. I may say that when we landed there was not sufficient gas in the balloon to keep it up. The first part of the descent was very rapid, so rapid that we let go our ballast. We had it in bags over the side, fastened at top and bottom, so that when we cut the string at the top the bag fell over and emptied. When the sand fell out, however, the particles were caught by the air, and the result was that, although it passed out of the bags, we were descending faster than it was, so that it seemed to go up, and as you will see presently, a good deal of it stuck to the varnished exterior of the balloon. The bags, too, when they were lightened of the sand, floated up until the balloon slackened its downward pace. It is worth noting that at 18,000 ft. as we were ascending, the balloon, which had been rather more than two-thirds inflated, was fully expanded, and at 22,000 ft. we lost a considerable amount of gas."

"Did you feel the loss of strength that Glaisher and Coxwell experienced?"

"Yes; it was quite astonishing. Our strength seemed to be quite gone. It was in view of this that we had fixed the sandbags as I have described, so that we could cut them loose. We might not have been able to lift them over the side."

Dr. Berson's High Ascent.

The following letter appeared in the "Daily News" of September 27th.:—

Sir,—Your numerous readers must have felt rather surprised when they read your able article in the "Daily News," of September 16, that "Dr. Berson claims to have already risen to an altitude of seven miles, or one mile higher than the awful record of Mr. Glaisher and Mr. Coxwell, when both were within an ace of perishing."

That we did attain the seven mile elevation has been accepted and recorded for the past generation by the most distinguished Fellows of the Royal Society, and by the Committee of the British Association, none of whom ever disputed the recorded observations by Mr. James Glaisher (a Fellow of the Royal Society) until Mr. Stanley Spencer assails his reputed veracity, and my own as well, by saying to the interviewer of a morning paper that his ascent with Dr. Berson from the Crystal Palace "was really the record," and "he knew that Glaisher and Coxwell reported that they reached 29,000 feet. But after my experience," continued Mr. Spencer, "I doubt it." So because he and Dr. Berson found asphyxiation becoming severe at 25,000 feet, Spencer rashly inferred that we could not have reached even 29,000 feet, and thought some error must have occurred.

Now although Mr. Glaisher was insensible for 13 minutes, the index of his minimum self-registering thermometer had been left at minus 11.9 degrees and this gave a height of 37,000 feet, fully seven miles.

I also, when on the hoop to let off gas for our descent, read a specially constructed aneroid barometer, which recorded the height at that time as seven miles.

Mr. Stanley Spencer, whose figures as to his own elevation are in all probability correct, places Dr. Berson's claim, if the meteorologist really said so, on the horns of a dilemma, for if the doctor had to cry out for oxygen while he was making a gurgling noise as he breathed at 25,000 feet over British soil, how did he manage in Germany to get seven miles, or 37,000 feet, without ceasing to breathe altogether?

But no doubt the learned doctor will fully explain all these matters, and will regret that he had not stipulated for silence on the aeronaut's part, and thus have his first say on debateable points, though how he could have managed to go 10,000 feet higher in Berlin than he achieved in England, after being nearly suffocated before he had got five miles up here, shows that his lungs and heart were not in such bad condition after all. The picture, however, as portrayed by the enterprising young balloonist, does not promise well for an extra two miles excursion upwards. Still, the respective disclosures by the scientist and the aeronaut, if they lack complete agreement, will prove edifying, and doubtless the dauntless professor

will put everything right when his personal account appears in print. — I remain, your obedient servant,

HENRY COXWELL.

Seaford, Sussex.

Some Balloon Record

There has been considerable discussion in the papers with regard to Dr. Berson's recent high ascent, and as to the real record height attained by a balloon. We therefore recapitulate a few facts bearing on the subject.

Herr Mullenhoff, of Berlin, classified ascents into those in which the elevation was measured with certainty, and those in which there was only a reasonable estimate. As, however, his figures vary somewhat with those given by Glaisher in his "Travels in the Air," the latter are also appended:

OF THE FIRST CLASS—

	Feet (Mullenhoff)	Feet (Glaisher
Welsh, Nov. 10, 1852 ...	22,700	22,930
Guy Lussac, Sept. 16, 1804	22,800	23,000
Barral and Bixio, June 26, 1850	22,876	—
Glaisher, June 26 ('63?), and Aug. 18, 1862 ...	23,100	{23,000 24,000
Sivel, Crocé-Spinelli, Mar. 22, 1875	23,720	—
Glaisher, April 10 (18?), 1863	23,720	24,000
Glaisher, July 17, 1862 ...	25,753	22,357
Glaisher, Mar. 31, 1863 ...	—	24,000
Gross and Berson, May 11, 1894	25,840	—
Tissandier, Sivel & Spinelli, Apr. 15, 1875	27,950	—
Glaisher, Sept. 5, 1862 ...	28,723	29,000
Berson, Dec. 4, 1894 ...	29,740	

OF THE SECOND CLASS HE GIVES—

Green, Sept. 27, 1836 ...	24,150	—
Mme. Blanchard, April 26, 1809	24,700	—
Hobard, Oct. 9, 1835 ...	25,784	—
Garnerin, Oct. 3, 1803 ...	26,600	—
Green and Rush, 1838 ...	26,871*	—
Cosmachi, 1842	27,542	—
Andreoli, April 22, 1808 ...	32,500	—
Glaisher, Sept. 5, 1862 ..	35,800	37,000

*Rush, in his "Account of Ascents," published in 1851, mentions only two ascents this year, of respectively 9,185 feet and 20,352 feet.

Small balloons with recording instruments have ascended over 60,000 ft.

As regards sojourns in the air:—

Andree, with a guide-rope, had been just upon 48 hours in the balloon at the time of dispatching his pigeon message.

M. Mallet in 1892 maintained himself for 36 hours in the air.

M. Hervé, on September 12, 1886, left Boulogne at 6.30 p.m. remained 24 hrs. 30 mins. in the air, and descended in the sea off Yarmouth.

The Great Leipzig balloon, on October 19, 1897, remained up with eight passengers for 24 hrs. 15 mins., during which time it travelled some 1,032 miles, probably the longest balloon journey ever made. Testu Brissy made a journey lasting 23¾ hours.

On March 25, 1875, M. Gaston Tissandier left Paris at 6.20 a.m., and descended in the Landes at 5 o'clock next morning.

Wise and La Mountain, in July, 1859, travelled from St. Louis to Henderson, N.Y. (850 miles) in 19 hrs. 50 min.

The "Great Nassau" balloon, on November 7, 1836, travelled over 500 miles to Weilburg, in 18 hours.

"Le Geant," in 1863, left Paris with nine persons, and made a very rough descent near Eystrup, in Hanover, after about 18 hours spent in the air.

On November 24, 1870, two aeronauts escaping from besieged Paris, landed in Norway, about 825 miles distant, after being 15 hours in the balloon.

The largest number of passengers taken in a free balloon trip was on November 17, 1889, when 20 persons (including four ladies) ascended in the great balloon (107,000 c. ft.) which had been used captive at the Paris Exhibition.

The balloon used captive at the Paris Exhibition of 1878 was the largest ever made, containing 883,000 c. ft., and could carry 52 passengers to a height of 1,640 ft.

The London captive of 1889 had a capacity of 350,000 c. ft.

The Paris captive, of 1889, made 1,121 ascents, and carried up in all 13,109 persons, including 2,499 ladies.

Andree's Polar balloon contained 162,000 c. ft.

As regards speed, though many statements have been made of greater rates, the highest well authenticated was that of De Fonvielle and Tissandier, in February, 1869. Ascending from Paris at 11.35, they reached an altitude of 3,280 ft., and in 35 minutes descended at Neuilly St. Front, which is 48 miles from Paris. They had therefore travelled at the

rate of 90 miles an hour. De Fonvielle again leaving Paris in 1870, reached Louvain in two hours, which gave a mean speed of 88 miles per hour.

Simmons, on June 10, 1882, left Maldon at 12.45, and, crossing the Channel, landed at 2.35 seven miles beyond Arras, the distance being about 140 miles (77 miles an hour).

Messrs. Green and Rush, in 1838, ascended to a height of two miles in seven minutes (25 ft. per sec.). Messrs. Coxwell and Glaisher descended on one occasion two miles in four minutes.

For number of ascents, the palm must probably be given to Charles Green, who made nearly 1,400 ascents. Coxwell has unfortunately kept no record. P. Spencer has made over one thousand. Louis Godard, last year, had made 625 free ascents. Wise made about 500, and Simmons 493.

A balloon used by Green made over 256 ascents.

Further Experiments in Flight.

By MAJOR MOORE.

I have been trying some further experiments for free flight with my clockwork model, as illustrated in the October, 1897, number of the "Aeronautical Journal." I find that by using the springs which I advocate for taking the strain of the wings, the model will fly a short distance, whereas, if I do not use the springs, the model will move forward only when running on a wire.

This proves that what I say about using springs like pectoral muscles is correct as described in my specification, No. 6, of 1895.

The springs store up the energy of the upstroke of the wings to increase the energy of the down-stroke

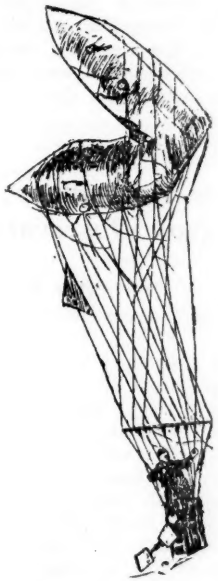
Many who are studying the subject of flight, realise the reciprocating action between the power and weight of the machine, when flapping wings are used, but have got into difficulties, like Mr. J. Marshall, through not using my springs. This they are welcome to do for experimental purposes, and I would willingly give them all information about them as far as in my power.

R. F. MOORE.

August 6, 1898.

A New Dirigible Balloon.

On the 20th September, M. de Santos Dumont ascended from the Jardin d'Acclimatation, Paris, in a balloon of his invention. It was of a long cylindrical form with conical ends, being 83 ft. long and 12 ft. diameter, constructed of fine Japanese silk by M. Lachambre. It had a capacity of 6,500 c. ft., and contained a compensating "ballonnet" of 880 c. ft. Two automatic valves regulated the pressure of the gas and the air respectively. On each side of the



[Illustration from *The Sunday Chronicle*

balloon was arranged a long horizontal pocket to contain battens of wood each a foot long. To the centres of each of the battens were fixed the suspension cords, this system doing away with the necessity of a net. For extra security bands were sewn over the upper part connecting the two pockets. The car, of basket work, was suspended from a horizontal steel bar, at a distance of 30 ft. below the gas vessel. The total weight of the apparatus was 130 lbs.

Attached, outside the car, was a small petroleum motor, formed of two superposed Dion-Bouton cylinders, of the same type as those used for motor tricycles and giving about 3 to 3½ horse power. The propeller consisted of an aluminium screw only 32 inches diameter, but

making 1,000 to 1,200 revolutions a minute. The weight of the motor, with screw, petroleum, etc., was 175 lbs.

At a quarter past four the balloon, inflated with pure hydrogen, ascended with the inventor, when it at once circled several times around the large captive balloon in the grounds, and then was directed towards the Bois de Boulogne at an altitude of about 600 ft., making several circles of about 100 yards radius. Soon, however, M. de Santos-Dumont had to stop the engine on account of the unsatisfactory working of a pump to drive air into the compensator, and the balloon lost its rigidity, and descended. It partially collapsed (as seen in the illustration) and fell rapidly to the ground. The aeronaut, though slightly shaken, was not much the worse, and has announced his intention to give the apparatus another trial.

*The Kite Equipment of the Arlington Observatory.**

Washington, Sept. 2, 1898.

Just outside of the city, about a mile from the old Lee home, at Arlington, Va., the Weather Bureau has established a kite farm, and is making experiments in the use of kites for weather observations. This aerial observation station is one of sixteen under the direction of the Bureau. Others are located at Cincinnati, Omaha, Topeka, Knoxville, Pierre S. D., Duluth, Cleveland, Cairo Ill., Sault de St. Marie, and Little Rock. Professor C. F. Marvin, who is in charge of this work, believes that valuable results can be obtained by the kite observation system, and has invented a number of devices for handling and managing the immense kites used at the Arlington station. One drawback to the use of kites has been the difficulty of controlling the big seven-foot affairs employed to carry the observing and recording instruments used in meteorological work. To cope with this difficulty Professor Marvin has built a new kite controlling machine, which makes it possible for one person standing before the reel to have within reach all the controlling handles, and to read the dials showing the amount of line run out, the pulling power of the kite, its elevation, distance, and electric connections.

As a further convenience, the kite is provided with a Shipman four-horse automatic oil-burning engine, to furnish power for pulling in the kite. The throttle of the engine is also within easy reach of the operator, so that the steam power can be applied instantly, and in case of an emergency the kite can be brought down rapidly.

The improved Hargrave kite is used almost exclusively for the regular observations, although experiments with new forms are still being made, many having curious shaped cells, some with divergent ends, wings, tails, and other queer appendages. The average size is seven feet long, six feet wide, and three feet high, the forward cell having a central horizontal division or intermediate supporting plane. Steel piano wire, 30-1000ths of an inch in diameter, weighing fifteen pounds to the mile, and capable of sustaining a tension of 300 pounds is used for kite-string. This is none too heavy, as in strong winds the pulling power of these kites frequently reaches 120 pounds or more. To have a kite fly away with the expensive instruments which it carries would mean a considerable loss, and the operators do not run the risk of sending the kites up in very heavy winds. The reel carries 20,709 feet, or nearly four miles of wire.

The ease with which Mr. Potter, who is in charge of the Arlington station, is able to handle his kites is at once apparent to the visitor to his kite-farm. Only a slight breeze is required to make an ascent. The kite is released and allowed to float some distance by unloosening the strap friction-brake which controls the reel. By applying the steam power, the kite is rapidly drawn in a considerable distance and soars skyward instantly. By repeating this operation several times the engine enables the meteorologist to send up a kite rapidly and without exertion.

As the wire unwinds from the reel, it passes down and around a pulley-wheel, thence up again, over a swivel-pulley wheel to the kite. The swivel-wheel turns on ball-bearings and adjusts itself to the direction of the kite, while the pulley-wheel below rests on springs or scales, registering in pounds the pulling power of the kite on a revolving drum or dynamometer before the operator. Mr. Potter has before him, on the machine, two indicators to show how much wire is released. One counting dial is attached to the swivel-wheel, and the other is operated by the revolution of the reel, so that the calculation is quite accurate. By means of a radius rod and arc, the inclination of the wire at the reel is determined, The radius rod is clasped upon the axle of the swivel-wheel, and by turning it around to meet the kite-line, the angle may be read on the arc. By reference to a tabulated chart, the observer

* By courtesy of the S. S. McClure Co.

can tell the exact height of the kite from the ground, knowing both the angle and the amount of line out. A theodolite and a nephoscope are also kept for determining accurately the height of ascents. The machine is even fitted with a guide to prevent the wire from being wound irregularly on the reel. This guide is automatically moved from side to side, and winds the wire with perfect regularity. The entire apparatus, with the engine and gasoline tanks, rests on a solid platform, and when not in use is protected by a wooden covering.

The great advance that has taken place in the aerial observations of the Weather Bureau is shown by the wonderful development of the recording instruments. Formerly a separate instrument was made for recording each of the conditions of the weather. Now an instrument has been adopted which performs the work of four separate machines, and is lighter than any one of the former instruments. The meteorograph, as it is called, records automatically, the humidity, barometric pressure, the temperature of the air, and the wind velocity. A record sheet, printed in four divisions for the varying degrees of humidity, barometric pressure, temperature and wind velocity, and divided up for the twelve hours of the day, is fastened around a drum, which, operated by clock-work, makes one revolution in twelve hours. It is upon this moving record sheet that the meteorological changes are indicated by the action of four delicate inking pens.

In preparing the instrument for use, the thermograph pen, which is operated by a special quicksilver tube, is adjusted to the line on the sheet to correspond with the surface temperature — that is, the pen point is lengthened or shortened to the point of the correct temperature mark. The humidity pen is then adjusted to agree with the percentage of humidity as determined from the readings of the sling psychrometer, by extending the pen to the proper point. In the same manner the pressure pen, recording barometric pressure, is set to the right point on the record sheet to agree with the reading of the barometer. The wind pressure indicator, of course, starts at the zero point. Each of the indicating mechanisms are made as simple and as light as possible.

With all the indicators set exactly, the meteorograph is put inside a thin covering, which is attached to the kite in such a position as to allow the air to pass through an open cylinder, in which it acts upon the recorders, and the pens mark out the changes. As the kite ascends, the clock-work slowly turns the record sheet, and the pens leave waving lines, which indicate precisely the conditions in the surrounding atmosphere as long as the observation lasts.

It is noticeable that all four records correspond with each other somewhat in movement. For instance, as the velocity is greater the temperature rises simultaneously, and a corresponding change takes place in humidity and barometric pressure.

At the sixteen stations, these records are made daily when the weather is favourable, and the record sheets are forwarded to the Weather Bureau, where they are studied, new facts regarding aerial conditions are learned, and the records kept for reference. One of the most interesting results is the forecasting of cold and warm waves. Such changes in the weather are found to be apparent at a great height long before they reach the earth, and kite records have shown the approach of a change fully twenty-four hours in advance of its first symptoms at the surface.

The dangers of the use of wire in flying kites to great heights can readily be understood. There is always more or less electricity on the wire, and the large amount of steel used in the new operating machine makes it dangerous to touch the reel at all. A ground connection is made to carry the current from the wire some distance away from the point of operation. Mr. Potter has a switchboard on his instrument, so that he can also direct the current from the wire to his kite house, for the purpose of making experiments with the atmospheric electricity produced. A spark three-fourths of an inch in length is often produced. In a number of cases, a storm coming up while a kite was up has done considerable damage. Recently at one of the stations, twelve thousand feet of wire were burned by lightning, and all the operator saw was a line of smoke extending up to the kite. Mr. Potter has two large kite sheds, in which are kept the newest designs of experimental kites, and instruments of various kinds used in the work.

The landing of a large kite is sometimes a difficult matter, when the wind is gusty and erratic near the surface. What is known as a landing line is generally used. When the kite is about 150 feet distant, an aluminium landing pulley attached to a line is slipped over the kite-line, an assistant follows the direction of the kite, drawing the line down until he is directly under the kite. He moves from side to side with the action of the kite, drawing the line nearer, until, when the darting motion of the kite has eased up, he draws it quickly to the ground.

The Arlington kite-farm being near Washington, is easy of access for the members of the Weather Bureau, who are at the head of the observatory system, so that the work of this station is being developed rapidly. Printed instructions and reports of the experiments and achievements throughout the country are sent from time to time to all the stations. The professors are deeply interested in the results of the study, but they realise that as yet comparatively little is known of the conditions of the upper atmosphere, and are confident that the researches being conducted by the Bureau will be productive of valuable results.

ALBERT B. LYON.

NOTES.

New Kite Record.—Blue Hill, Aug. 26.—The world's record for high kite flight was broken this afternoon at Mr. Rotch's observatory by Messrs. Clayton and Fergusson, who dispatched a tandem of kites into the air until the highest one reached an altitude of 12,124 feet above the sea level, a height 360 feet greater than any kite has reached heretofore. The top kite was of the Lamson bird pattern, and had an area of 71 sq. ft. The other kites were the modified Hargrave box variety, and had a combined area of 149 sq. ft. All the kites were fitted with self-regulating, elastic bridles, invented at the observatory, to prevent the kites from exerting a dangerous pull. Five miles of line, weighing 75 lbs., was let out, while the weight of the kites, recording instrument, and secondary line, was 37 lbs., making a total of 112 lbs. lifted into the air. The recording instrument was made by Mr. Fergusson, of aluminium, weighing 3 lbs., and registering temperature pressure, humidity, and wind velocity. The ascent was begun about 11 a.m., and the highest point reached at 4.15 p.m. The kites were drawn in by a steam windlass, and the last one reached the ground before 9 p.m. The kites passed through clouds when about three-quarters of a mile above the surface of the earth, and while above the clouds the hygrometer showed the air to be very dry. At the highest point, the temperature was 38 degs., and the wind velocity 32 miles an hour. At the ground, at the same time, the temperature was 75, and the wind velocity 22 miles. The highest wind velocity recorded was 40 miles an hour at a height of 11,000 ft. The wind on the ground at this time was from the west, while at the highest point reached by the kites it was W.S.W. The flight to-day was one of a series of high ascents made during the spring and summer, averaging about a mile and a half, while on several occasions, a height of over two miles has been attained.

An Aerial Ship.—Professor Giampietro, of the University of Pavia, has designed an aerial ship, consisting of an immense hollow cylinder of aluminium, like a cigar in shape, and rigged above like a three-masted sailing ship. There are also aeroplanes, or rather great wings, and aerial screws projecting from the sides. A car is hung underneath. The sails on the masts are for driving and steering the vessels, the side wings for rising and sinking without the use of ballast. The side screws are also for propulsion and steering.

Balloons in the Spanish-American War.—But few details have been published regarding the American War Balloon, which ascended near Santiago during the recent fighting. It is said to have afforded a most valuable means of reconnoitring, but it seems to have been shot down by the enemy's fire, a rather unexpected result considering that such an eventuality has hitherto been thought unlikely, and the Spanish shooting was not conspicuous at other times for its accuracy.

A Duchess as Aeronaut.—From Vienna we learn that the Duchess of Aosta, a daughter of the late Prince Jerome Napoleon, is an enthusiastic aeronaut, and considers ballooning the most suitable high society sport. The duchess is now staying at Arco, and has hired a balloon for a month, besides engaging two aeronauts to initiate her into the mysteries of ballooning. It is said that she makes an ascent every day, accompanied by her maid. She has ordered a balloon of her own, and at the expiration of the month intends to undertake some longer trips. Ballooning, she declares, is far superior to mere yachting, and must inevitably become the sport of the aristocracy.

Aeronautics at the British Association.—In addition to the paper on "Balloons for Geographical Research," which is reproduced elsewhere, the following papers bearing on the subject were read: — Mr. Eric Stuart Bruce, in a paper on "The Use of Electric Balloon Signalling in Arctic and Antarctic Expeditions," dealt with the system of electric balloon signalling, invented by himself, which has already been described. The apparatus consists of a balloon, made of a translucent material and filled with hydrogen or coal gas, in which are placed several in-

candescent electric lamps in metallic circuit with a source of electricity on the ground or the deck of a ship. In the circuit on the deck is an apparatus for making and breaking contact rapidly, and thus, by varying the duration of the flashes of light in the balloon it is possible to signal according to the Morse code. Mr. Bruce claimed that his electric balloon had been successfully manipulated not only in fair weather but in half a gale, a snowstorm and mist. Regarding the distance to which signals might be transmitted, he thought it reasonable to expect that, given a sufficient altitude a high candle power, and a clear atmosphere, through a telescope the flashes would be visible some 80 or even 100 miles. A communication from Dr. A. Lawrence Rotch on the "Exploration of the Upper Air by Means of Kites at Blue Hill Observatory, Mass., U.S.A.," was read by Dr. Howard. Since the last report presented at Toronto great progress has been made in the work. The Hargrave kite has been perfected by making it larger, more rigid, and relatively lighter, and by concaving the surface exposed to the wind the vertical component of the latter has been increased. In general, these kites, with a short line, rise from 50 to 60 degrees above the horizon, and pull about one pound per square foot of lifting surface in a wind blowing 20 miles an hour. Elastic bridles diminish the angle of incidence of the wind as its pressure increases, and thereby enable the kites to fly in gales. A meteorograph made by Mr. Fergusson, which records the pressure, temperature, and humidity of the atmosphere and the velocity of the wind weighs but three pounds. Since the use of wire and more efficient kites the mean height of the flights has been increased to more than 7,000 ft. during the past few months. On six occasions 10,000 ft. was reached, the maximum altitude attained being 11,440 ft. on August 26, 1898. Mr. Douglas Archibald said he had first begun meteorological observations with kites in 1884, and he attached considerable value to their use for many purposes. Kites could support considerable weights, and transfer them from place to place. He was at Blue Hill Observatory, Massachusetts, some time ago, when the kites were flying at a height of 7,300 ft. The connecting wire broke and a box containing instruments was seen to be soaring away so far into space that it could only be distinguished by a telescope. A bicyclist, however, rode hurriedly off in the direction taken, and was fortunate enough to find that the instruments had been gently dropped, absolutely uninjured at a distance of six or seven miles. The kite-balloon combination, such as was now used in Germany, suited the two conditions of wind and calm. Kites could be used very advantageously for photographing from great heights either unknown country or the position of an enemy. Some of the officers in the Tirah campaign had said that with kites they could have photographed the enemy's position. Aerial reconnaissance was one of the coming features of warfare. A small kite could take up a greater weight to a greater height than any balloon.—Thanks were voted to the readers of the papers.

Narrow Escape of a Parachutist.—Carelessness and inexperience once again nearly caused a catastrophe. The "Morning Leader" reports: "It was at Mussourie, in the Deccan, where a young man was making his first ascent, and when about 100 ft. from the ground the balloon burst from top to bottom. 'Let go!' was yelled from below by a hundred throats, and the young man had the presence of mind, though flying through air, to detach his parachute. It was an anxious moment. A discordant yell went up from the assembled multitude, and shrieks in various keys from the ladies. Everyone expected to see the unfortunate man killed or seriously injured; but when about 10 ft. from the ground the parachute opened, and he landed fairly easy. In inflating the balloon the flames had gone too high and charred the cloth.

To Paris by Balloon.—Mr. Arthur Williams has announced his intention of shortly attempting a balloon voyage from London to Paris. He will be accompanied by Mr. Brewer and a reporter. It is said that "he does not mean to try any steering apparatus, only to start with a favourable wind." If so, he may have to wait a very long time, and, moreover, if he gets his favourable wind to start with, it is extremely doubtful how long that will continue.

The Aerostatic Railway.—The most remarkable railway in the world has for its motive power not steam or electricity, but a balloon. Stranger still, the official stamp of approval has just been put upon this most marvellous railroad, which goes to and from the summit of Hochstauffen Mountain, at Bad Reichenhall, the well-known watering place in the Austrian Alps. The Aerostatic Railway—to give it its correct designation—owes its inception to the well-known inventor, Herr Volderauer, who had long convinced the experts that his scheme was perfectly feasible and safe. A single rail guides the cars, and keeps the balloon with its load captive, the cars gripping the rail at the sides and underneath the flange. At about every 15 ft. the line is firmly anchored.

In descending the mountain, of course, gravity is the propelling force, water ballast being taken on board at the upper end to counterbalance the buoyancy of the balloon. The cock on the water-tank of the car can be opened by the operator at any time. The tank carries about 800 lb. of water, and the tank and car together weigh about 600 lb. The balloon is 67 ft. in diameter, and exerts a lifting capacity of something over 11,000 lb. Weights also can be taken on board and discharged at the various stations along the line. At the foot of the track are the gas tank and generator. The summit of the Hochstauffen offers a sublimely beautiful view; but before the advent of the Aerostatic Railway the climb was both long and tedious. It was only attempted by experienced mountaineers. — "Invention."

Liquefied Gas for Ballooning.—Now that we can carry light gases, such as hydrogen and coal gas, in the form of liquid, it is probable that a new departure will be made in ballooning, either in the shape of gas motors for propelling the balloon, or to increase the ascensional force. The liquid gas can take the place of ballast. Professor Errera, of the University of Brussels, proposes to surround the balloon with a kind of collapsible life belt or buoy, which can be inflated or emptied of gas at will by means of pipes and stopcocks communicating with the bottles containing the liquid gas or with the open air. To ascend, the gas would be let into the buoy, and to descend it would be let out. With a good portable machine for liquefying the gas it could be brought back to the liquid form and restored to the bottles.—"Globe."

Foreign Aeronautical Periodicals.

L'AERONAUTE (Paris).

Juillet, 1898. No. 7.—Lettre du Comité de l'Exposition de 1900 et rapport du secrétaire de la Commission—Société Française de Navigation Aérienne. Séance du 5 Mai, sous la présidence de M. Radau; Séance du 2 Juin, sous la présidence de M. Triboulet—Séance du 16 Juin, sous la présidence de M. Radau—Compte rendu aéronaute de divers journaux français et étrangers—Lettre de M. Variclé—Souscription pour le médaillon de M. Hureau de Villeneuve—Ecole Française de Navigation Aérienne: Ascension du 7 Aout 1898 et convocation aux élèves volontaires.

Aout, 1898. No. 8.—Exposition de 1900—Composition des Sous-Commissions et liste alphabétique des membres du Comité avec indication de leurs fonctions—Société française de Navigation aérienne—Séance du 7 juillet (Assemblée générale).—Compte rendu aéronautique de divers journaux français et étrangers—Recettes et procédés: Pégamoïd, Ripolin, Cellulose nitrée—La liquéfaction de l'hydrogène et les ballons, par M. Errera, professeur à l'Université de Bruxelles—Ecole française de Navigation aérienne, remise de l'ascension au 25 septembre prochain—Souscription pour le médaillon de M. Hureau de Villeneuve—Photographies—Ballon en aluminium de MM. Sibillot et Vernanchet—Les élèves et les professeurs de l'Ecole française de navigation aérienne. 1re section sur le terrain (Pratique).

September, 1898.—Projet de lignes de ballons par M. de Poulpiquet—Laçon ana éléves de l'Ecole (M. Hauvel)—En ballon dirigiable MM. Santos-Dumont et Debayeux—Observations de MM. Charles Sibillot, de Fonvielle et Mallet—Faits divers.

LA FRANCE AERIENNE (Paris).

1er au 15 Juillet, 1898.—Bulletin météorologique mensuel.—Jurisprudence colombophile: A propos des déclarations antérieures à la loi de juillet 1896—Parachute dirigeable: système Carelli préconisé par M. Vialardi; appréciation de M. Jobert (avec dessins)—Le calendrier du colombophile—Inauguration d'un colombier maritime à Rochefort-sur-Mer—Flagrante delicto—Louet: Ascension de la Ville-de-Corbeil—A la volée—Tribune libre: Lettre de MM. Aphone et Loy—Correspondance—Revue de presse—Académie d'Aérostation Météorologique de France: Séance du 1er Juin 1898.

15 au 31 Juillet, 1898.—J. Maret-Leriche: A propos du Congrès de 1900—Colombophilie militaire: L'internement des Pigeons voyageurs—C. Jobert: L'aviateur mixte de Louis Roze—Tribunaux. Colombophilie judiciaire: Gigot contre Rosoor-Delattre. Condamnation de ce dernier—Le Messager angevin. Distribution des récompenses—Les Voltigeurs de l'Est; Fête annuelle—A la Volée.

Supplément: Variétés. Emile Cruchet: Propos du Jour—Correspondance: Lettre de MM. V. Rouma et Loy—Revue de presse: The aeronautical journal. Sommaire 1898—Le premier voyage aérien, pièce historique de Louis Figuier (suite).

1er au 15 Aout, 1898.—Bulletin météorologique mensuel—Docteur Ox: Un an après—Calendrier colombophile—A. Huard: Byzance—L'aéronautique au jour le jour: direction verticale des ballons, système Tival—Le Messager rochefortais—A la volée La Fête nationale en province: à Lyon, Vienne, Roanne, la Bassée, Lille—Variétés: Le premier voyage aérien (suite).

15 au 31 Aout, 1898.—Docteur Ox.: Herr Bismarck—La Colombophilie au jour le jour: A propos des juniors, E. Caillé—E. Tincelé: Exposition d'aviculture—A. Huard: L'Avion-Ader—L. L.: L'Eclair de Talmont—A la volée—Revue de presse: Essais avec le ballon cerf-volant météorologique de M. W. L. Moedebeck—Variétés: Le premier voyage aérien (suite et fin)—Tribune libre—Académie d'Aérostation Météorologique de France: séance du 20 juillet, 1898.

1er au 15 Septembre, 1898.—Bulletin météorologique mensuel—Tribulations pigeonnières: Docteur OX—Le calendrier du colombophile—La colombophilie en Vendée: Pigeon—L'aviateur Mixte: Carelli—L'escargot volant: A. Huard—Byzance: Maret Leriche—A la volée—Variétés—Propos du jour: Emile Cruchet—Aéronotique rétrospective—La chute du Montgolfier—Annonces.

Du 15 au 30 Septembre, 1898.—La colombophile a l'Exposition de Villemonble: Doctor Ox—Apropos du Congress de 1900: Maret Leriche-Etudes Aerienne; du vol de l'oiseau: E. Guinet—l'Aeronautique au jour le jour: C. Mathieu—A la volée.

L'Aerophile (Paris).

June, July, August.—W. de Fonvielle: Le docteur Hureau de Villeneuve—Alexandre Salle: Sejours prolongés daus l'Atmosphere—l'Exploration de la haute atmosphere a l'Academie des Sciences—A. Berson: les ascensions montees de Berlin—V. Cabalzar: l'Aeronautique à l'Exposition Universelle—Santes-Dumont: Une ascension au Jardin d'Acclimatation—Le ballon captif de l'Exposition de Turin—Ader: sur des apparils d'aviation—Le traversee de l'Afrique en ballon—W. Fonvielle: L'hydrogene liquide.

Zeitschrift fur Luftschiffahrt (Berlin).

June-July.—Die Internationale Aëronautische Conferenz zu Strassburg i. E. vom 31. Marz bis 4. April 1898—Kress: Ueber dynamische Luftschiffahrt mit Vorfuhrung freifliegender Apparate—Kleinere Mittheilungen: Milla, die archimedische Schraube in einfacher Darstellung—Zu Karos, „Ein Universal-Drachenflieger mit rotirenden Tragflachen"—Vereinsnachrichten: Milla, Carl Bosse—Wiener Flugtechnischer Verein. Protokolle der Plenarversammlungen vom 4. Januar, 18. Februar, 15 Marz und 15. April 1898.

August.—v. Parseval, Ueber das Segelproblem—Weisse, Ueber den heutigen Stand der Luftschiffahrt und die Einfuhrung von Flugapparaten nach dem Buttenstedt'schen Princip in unsere Verkehrs-Praxis—Deutscher Verein zur Forderung der Luftschiffahrt zu Berlin. Verzeichniss der vom Verein seit Juni 1897 mit seinen beiden Ballons „Sportpark Friedenau I und II" bis jetzt veranstalteten Vereinsfahrten—Vereinsnachrichten: Protokolle der Sitzungen des Deutschen Vereines zur Forderung der Luftschiffahrt vom 28. Februar, 28. Marz und 25. April 1898—Berichtigung.

Illustrirte Aeronautische Mittheilungen (Strassburg).

July.—Die Konferenz der Internationalen Aëronautischen Kommission zu Strassburg—S. A. Andrées Polarfahrt im Luftballon, von Dr. Nils Ekholm (Schluss)—Buttenstedt und die Flugfrage, von Arnold Samuelson—Die Luftschiffertruppe der I. franzosischen Rupublik, von Fingerhuth (Schluss)—Versuche mit dem meteorologischen Drachenballon, von H. W. L. Moedebeck—Neue Ideen, von A. Platte—Bericht uber eine wichtige Entdeckung, von Karl Steffen—Komprimirte Luft als neuester Ballast fur Luftschiffahrt—Zur Begutachtungsstelle von Entwurfen fur Luftfahrzeuge—Kleinere Mittheilungen—Aus unseren Vereinen—Aus anderen Vereinen—Patente in der Luftschiffahrt—Eingegangene Bucher und Separatdrucke—Zeitschriften-Rundschau—Aus anderen Zeitschriften—Neue Nachrichten—Todtenschau.

Notable Articles.

July 2. *Revue Scientifique* (Paris).—"Kites" (illustrated), also "Project for an Aerial Ship" (Giampetro's). (Illustrated.)

2. *Golden Penny.*—"Balloons for Naval Operations." (Illustrated.)

28. *Daily Graphic.*—"Aerial Research." J. M. Bacon.

28. *Daily News.*—"Up in the Air—Scientific Ballooning."

July 29. *Daily Chronicle.*—"Science in a Balloon."
Aug. *Le Spectateur Militaire* (Paris).—"Meteorology and Ballooning."
3. *Commerce.*—"Mr. G. L. O. Davidson." With portrait and illustrations of flying machine.
5. *English Mechanic.*—"To the North Pole in a Flying Machine—Balloon Navigation." E. E. WILSON.
13. *Golden Penny.*—"Atkins as an Aeronaut." Illustrated account of ballooning in the British Army.
18. *Nature.*—"The International Aeronautical Conference."
20. *Golden Penny.*—"Another Flying Machine" (Ader's). (Illustrated.)
20. *Revue Scientifique* (Paris).—"Across the Sahara by Balloon." L. DEX.
23. *Daily Graphic.*—"Echoes in the Air." Some observations from a balloon, by J. M. BACON.
27. *Golden Penny.*—"Mr. G. L. Davidson's Dream of the Future." (Illustrated.)
Sept. *Forum.*—"The Balloon in Warfare." Prof. H. HERGESELL.
2. *English Mechanic.*—"Ballooning to the Pole." E. WILSON.
15. *Daily Mail.*—"Balloon Photography." (Illustrated.) Rev. J. M. BACON.
17. *Daily Telegraph.*—"Notable Balloon Ascent," Dr. Berson's.
28. *Cassell's Saturday Journal.*—"Round the World in Eighty Hours."
30. *Daily Chronicle.*—"A Night in a Balloon."
Also many letters in *English Mechanic.*

Applications for Patents.

(*July, August, September*, 1898.)

14,618. July 2. H. S. F. WARTH, 11, Burlington Chambers, New Street, Birmingham. **Improved Aerial Flying Machine.**

15,324. July 12. C. E. HITE, Norfolk House, Victoria Embankment, London. **Improvements in Air Ships.**

16,136. July 25. JAMES ROOTS, 100, Westminster Bridge Road, London. **An Improved Aerial Machine.**

16,181. July 25. MAX LOCHNER, 18, Buckingham Street, Strand, London. **Improvements in or Relating to Air Ships.**

17,395. August 12. W. COCHRANE, 67, Cadogan Square, London. **A New or Improved Flying Machine.**

17,654. August 16. W. H. GILMAN, 45, Southampton Buildings, Chancery Lane, London. **Improvements in Aerial Conveyers.**

17,667. August 16. F. MCLAUGHLIN, 154, St. Vincent Street, Glasgow. **Improvements in Elevating and Propelling Devices for Air Ships.**

17,943. August 20. H. S. BOOTH, 1, Park Avenue, Southport. **Improvements in Aerial Machines.**

17,953. August 20. EDWARD ANDERSON, 70, Chancery Lane, London. **An Improved Flying Machine.**

18,219. August 24. OSKAR LANGE, 115, Cannon Street, London. **Improvements in and Connected with Air Ships, and in Means for Propelling and Steering the same.**

18,421. August 27. GUSTAV KOCH, 6, Lord Street, Liverpool. **Improvements in Flying Machines.**

18,780. September 2. THOMAS MOY, 8, Quality Court, London. **Improvements in or Relating to Means and Appliances for Effecting Aerial Navigation.**

18,896. September 5. L. W. BROADWELL, Lydian House, Westbury Gardens, Clapham Park, London. **Improvements in Flying Machines.**

19,257. September 9. W. R. SMITH and E. R. SMITH, 117, Victoria Street, London. **Improvements in Apparatus for Flying.**

Patents Published.

From the *Illustrated Official Journal.*

3608. February 10, 1897. **Flying Machines.** LANCHESTER, F. W., Cobley Hill, Alvechurch, Worcestershire.

The improvements relate to projectiles as well as to machines for aerial navigation. The body is made with a stream line form, and is provided with fore and aft vertical fins or a single fin for steadying and directing the machine, and with wings or aeroplanes for supporting the weight of the machine and for directing it. The aeroplanes are built up of wire and tube framing with silk or sheet aluminium covering, or in small structures of a single piece of wood. The covering of the upper surface may be made less pervious to the air than that of the lower in order that internal pressure may aid in preserving the form. The aeroplanes may have vertical portions at the ends, and in that case are made shorter. When the machine is to be self propelled a motor drives a screw propeller having a continuous rim to serve as a flywheel and wire tension spokes, between which are fitted canvas or wooden blades. The form of machine to be used for navigation is shown in side elevation and in half front elevation. Two propellers are used, and are driven in opposite

directions by a gas or oil engine or a pair of such engines with oppositely rotating parts. A conical projection extends behind the rear propeller. A rectangular framework connects the various parts, and the fins are in duplicate, the rear fins being adjustable about vertical axes. The rear aeroplane is adjusted in inclination by cords from the occupant's car. The direction of motion may also be modified by the movement of ballast or of the occupant. In order to launch the machine or torpedo, two parallel wire ropes are employed as guides, the machine being held down by cord lashings till the moment of leaving the wire rope track, when the cords are severed by suitably placed knives. The initial motion may be given by a cable and winding engine or by a catapult arrangement.

5739. March 4, 1897. **Flying Machines.** MOLESWORTH-HEPWORTH, E. N., Holly House, Ashton-on-Mersey, Cheshire.

Four or more aeroplanes are mounted on cross yards, fixed to a central member. A framing suspended from the aeroplanes carries propellers and a car. The propellers are driven by the occupant by means of pedals and rope gearing or by a motor. A rudder is under the control of the occupant, and he can also adjust the relative inclination of the car and the aeroplanes by winding the rope on and off the shaft. The aeroplanes are concave, but are open in front, and have an extended serrated edge at the back; vertical longitudinal strips divide the under surface into several channels.

6320. March 10, 1897. **Flying Machines.** SIMMS, F. R., 12, Norfolk Street, Strand.

Refers to aerial machines described in Specifications Nos. 25,716 and 25,717, A.D. 1896. Propellers with blades of a uniform width of light material, increasing in pitch from the boss to the rim, are mounted on spindles, which are driven by bevel gearing and belts and from a pedal crank. The inclination of spindle may be adjusted by a handle for the purpose of steering. If wings are employed, only one propeller is necessary.

7012. March 17, 1897. **Aerial Machines.** DIESEL, R., Giselastrasse, 14, Munich, Bavaria.

To enable the cable supplying electricity from the ground to the electrically-propelled aerial machines to become longer or shorter as the machine is swayed by the wind, it is coiled on a drum at one end which is constantly tending to wind it up. The drum may be turned by an electromotor which is reversed by the pull of the cable when it becomes excessive, or the drum may be driven through a clutch which is thrown out of gear by an excessive pull on the cable, and into gear by a spring when the pull is diminished.

9734. April 17, 1897. **Flying Machines.** MARSHALL, J., 23, Rockingham Terrace, Birdwell, Barnsley, Yorkshire.

Refers to Specification No. 10,239, A.D. 1895. A cage carries one or more masts, each of which is provided with two pairs of wings and an aeroplane. The upper pair of wings is pivoted directly to the mast, and the lower to a sliding collar which is connected with the aeroplane so that the latter moves up and down with it. The wings and the aeroplane are actuated by a compressed-air motor which is supplied with compressed air by a pump in the car driven by a gas or oil engine. Each of the cylinders of the motor has two pistons working in opposite directions and working the wings simultaneously. Spring or india-rubber stops limit the strokes of the wings, and the lower pair with the aeroplane may be fixed in position by a catch. The valve regulating the action of the motor is driven from the arms of the wings. The wings and aeroplanes are concave, and have flexible steel tubular framing. The hollow masts, &c, serve as reservoirs for compressed air.

9864. April 20, 1897. **Aerial Machines.** BEENEN, B. R., Moritzstrasse, Dresden, Germany.

Two cars, a lower one for passengers and an upper one for carrying the motor, are provided with one or more lifting screws and horizontal propelling screws. The machine is steered by means of a fan mounted behind. The shafts of the lifting and propelling screws can be turned in a vertical plane so as to alter their inclination and to enable the propelling screws to assist in lifting; the shafts are held in any desired position by fixing the collars to a quadrant. The screws are constructed with a hollow conical centre to guide the air, and a ring fitted with vanes made concave on the pressure side and pivoted on radial bearings. The inclination of these vanes can be adjusted by a set of rods joined to a collar, the position of which can be regulated. The vanes can thus be reversed or made to form a continuous surface and act as a parachute in case of accident to the motor. The machine is provided with wheels and runners to facilitate starting and landing.

10,620. April 28, 1897. **Flying Machines.** MAXIM, H. S., 18, Queen's Gate Place, Middlesex.

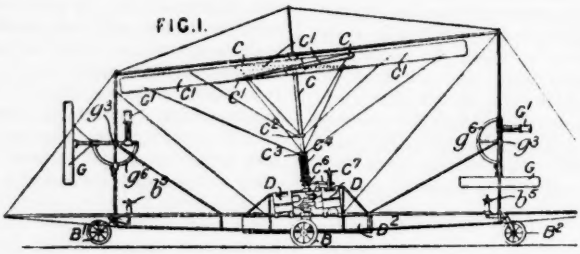
The machine is supported and driven by two large screws, one on each side of the machine on nearly vertical shafts. One of these screws is shown in side elevation in Fig. 1. As shown, it is of small pitch, and has four blades C^1. Its shaft C is inclined forwards, and is driven by a four-cylinder steam or gas engine D. The blades of the screws are stayed so as automatically to diminish in pitch as the air pressure below them increases. The leading edges *c* of the blades are stayed to a fixed collar C^2, and the rear edges C^1 to a sliding collar C^3 attached by springs C^4 to a collar C^6, which can be adjusted to a suitable position by a hand-wheel C^7. The machine, when on the ground, rests on wheels B, B^1, B^2, of which B^1 and B^2 can be adjusted in height by hand-wheels

b^3. In addition to the large screws already described, the machine carries two smaller screws G, one in front and one behind. These are mounted, with their motors G^1, on frames g^6 turning on trunnions g^3 so that the screws may be used for either lifting, lowering, or propelling. The screw blades are of light pinewood strengthened by transverse strips covered with strong fabric, such as silk or linen, or they may be made with steel framework covered with strong fabric. In starting the machine it is run forwards, *i.e.*, to the left, until the screws C^1 assert their lifting effect. These screws act in the manner of aëroplanes or wings. The blade which is moving forwards is nearly horizontal, as shown in dotted lines, and offers little resistance to the air, but on its return it has a propelling effect. Rolling is counteracted by the automatic action of a weighted pendulum which, when the machine rolls to one side, cuts the supply of motive fluid from the motor D on the side which is higher, and opens wider the supply valve of the motor on the lower side. Fore and aft balancing is regulated by a sliding platform regulated by a hand-wheel. The motors D have four cylinders arranged in pairs opposite one another, and driving cranks at 180° so that, with a four-stroke cycle, an impulse is obtained every half revolution. The motors are preferably driven by acetylene, which is stored in reservoirs D^2 and is mixed with about one-fiftieth by volume of acetone or acetic ether or other suitable compound to produce a mixture which can be kept liquid at a lower pressure than acetylene alone. The tubular framing may be used for cooling jacketing-water or condensing steam.

10,811. April 30, 1897. **Aerial Machines.** FRICKE, G., Friedeburg a/Saale, Germany.

The machinery is located in the space between the two buoyant chambers A and B. A hinged rudder carried at the rear can be manipulated from the chamber. Propellers mounted so as to be separately driven if desired, are carried on each side of the machine. By means of a pump air or gas may be made to pass from either A or B, or from B to A, through the pipe which may be connected to the atmosphere by a cock. D and E are air chambers similarly connected with one another and the atmosphere by a pipe, pump, and cock. The transference of air or gas from A and E to B and D, or *vice versa*, serves to steer the machine in an upward or downward direction as desired.

FIG. I.



United States Patents.

606,942. August 9, 1897. **Flying Machine.** J. T. RICE, Hot Springs, Ark.

Elongated balloon, with numerous propellers mounted on shaft below.

606,960. January 24, 1898. **Kite.** JOHN DOYLE, Hoboken, N.J.

Kite constructed in the form of a boat, with sails, &c.

607,240. July 12. **Air Ship.** C. E. HITE, Philadelphia, Pa.

Elongated balloon.

607,129. July 12. **Kite.** S. A. POTTER, Washington.

Diamond-shaped box kite.

608,823. October 12. **Kite.** W. S. BAKER, Newark, N.J.

Ordinary diamond-shaped kite, pocket for backbone.

610,843. March, 1897. **Aerial Ship.** T. J. BROWN.

Body provided with series of independent gas cylinders propelled by screws.

French Patents.

274,316. PAJER. **Dirigible Balloon.**

275,401. ALAUX. **Apparatus for the Purpose of Aerial Navigation.**

275,602. DUSSEQUE. **Dirigible Balloon.**

276,035. METTRIER. **Aerial Propeller.**

276,134. COTTESSAT. **New Propeller for Aerial Navigation.**

277,157. MOLNAR and HORBIGER. **Machine to Fly in the Air.**